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EFFICACY OF SELECTED GRANULAR INSECTICIDES FOR THE CONTROL OF MAIZE-STEM BORER (*CHILO PARTELLUS*) (LEPIDOPTERA: PYRALIDAE)

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ABSTRACT

Stem borer (*Chilo partellus*) is the most destructive pest of maize causing considerable yield losses especially during *yala* season. At present the pest is managed through whorl application of insecticide granules or foliar spraying of liquid formulations of insecticides. However, effective control of the pest cannot be expected from liquid formulations due to practical difficulties in the spraying especially at the mature stages of the crop. Hence, investigations were carried out in two consecutive *yala* seasons in 2008 and 2009 to study the efficacy of granular type insecticides against the stem borer. The maize hybrid variety Sampath was used. Four insecticides were tested along with an untreated control. Insecticides were applied twice as whorl applications at 2 week interval.

The percentage stem borer damage in plots treated with Diazinon 5G, Fipronil 0.3G and Thiocyclam hydrogen oxalate 4G found to be < 8% as compared to > 35% damage in untreated control. Larval population and severity of stem borer damage were also significantly low in Diazinon 5G, Fipronil 0.3G and Thiocyclam hydrogen oxalate 4G treated plots during both seasons over the control. The percentage seed yield in Diazinon 5G, Fipronil 0.3G and Thiocyclam hydrogen oxalate 4G treated plots found to be 52-91% and 28-44% higher than the untreated control during *yala* 2008 and 2009 respectively. Therefore, Fipronil 0.3G and Thiocyclam hydrogen oxalate 0.4G can be recommended in addition to the present recommendation of Diazinon 5G for the control of stem borer in maize.

Key words: *Chilo partellus*, Granular, Insecticides, Maize, Stem borer

INTRODUCTION

Maize (*Zea mays* L) is one of the most important cereal crops grown in Sri Lanka. The area under maize in Sri Lanka is about 51,000ha and production is about 112,000t in 2008 (AgStat, 2009). In terms of area and production, it ranks second after rice among the cereal grains (Hindagala, 1980). Maize stem-borer (*Chilo partellus*) is considered as the most destructive pest causing losses up to 75%. Infestations at seedling stage may cause a total failure of the crop (Khan *et al*. 1999, Rahim and Masud 1992, Sekhon and Kanta 1992). This pest also attacks other grain crops such as sorghum, millets, sugarcane and rice.

The young stem-borer larvae are small, spotted and yellowish. When full grown, they are 20 to 25mm long and spotted with coloured stripes along the back of the body. Pupation takes place in the stem in a small chamber. The straw colored moth (15mm), deposits white scale like eggs in overlapping rows, usually on the underside of the leaves (Alejandro 1987). Stem-borer starts to infest the crop at 3 to 4 weeks after planting and continue up to maturity stage (Subasinghe 1988). Larvae which attacks all parts of the maize plants except roots injure the young leaves and later bore into the stem, tassels, stalks and ears of the maize plants (Khan and Amjad 2000). The present recommendations for the management of this pest include foliar spraying of Novaluron 10EC, Thiodicarb 375SC, Etofenprox 10EC or application of granular formulation, Diazinon 5G. However, effective control of the pest cannot be expected from liquid formulations due to practical difficulties in application especially in the advance stages of the crop. On the other hand, Diazinon, the presently recommended granular insecticide for maize stem borer, is a moderately toxic insecticide. Realizing these limitations, experiments were conducted during *yala* 2008 and *yala* 2009 to study the efficacy of more safer granular type insecticides against stem borer and to review the efficacy of presently recommended insecticide Diazinon 5G.

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MATERIALS AND METHODS

The experiment was conducted in two consecutive *yala* seasons adopting randomized complete block design with 4 replications. Variety "Sampath" was used. Seeds were sowed at a spacing of 60×30cm on plots measuring 3.6×3m. All the cultural practices recommended by the Department of Agriculture were followed. The following insecticides were tested at the given rates (Table 1).

Table 1. Tested insecticides against maize stem borer during *yala 2008 and 2009* and their rate of application

Insecticide formulation	*Rate of application*		*WHO Hazard Category*	
	(kg/ha)	*(gai/ha)*	*a.i.*	*Formulation*
Diazinon 5G*	15	750	II	III
Fipronil 0.3G	12	36	II	IV
Thiocyclam hydrogen oxalate 4G	15	600	II	IV
Thiocyclam hydrogen oxalate 4G	20	800	II	IV
Imidacloprid 0.3G	10	30	II	IV
Imidacloprid 0.3G	15	45	II	IV

*Recommended insecticide

Insecticides were applied 2 times at 3 and 5 weeks after sowing as whorl application. Percentages of damaged plants were recorded before application of the insecticides and 7 days after first and second applications. Number of stem borer larvae and pupae in 10 randomly selected plant stems was recorded at 8 weeks after planting. Scale developed by Guthrie *et al.* (1960) has used to estimate the severity of leaf damage (Table 2).

Table 2. Severity scale of leaf feeding damage

Scale	Damage Severity
1	No visible leaf injury or a small amount of pin or fine shot hole type injury on a few leaves
2	Small amount of shot hole type lesions on a few leaves
3	Shot hole injury common on several leaves
4	Several leaves with shot hole & elongated lesions
5	Several leaves with elongated lesions
6	Several leaves with elongated lesions about 2.5cm long
7	Long lesions common on about half of the leaves
8	Long lesions common on about 2/3 of leaves
9	Long lesions in more than 2/3 of leaves

Severity index was calculated using the following equation and seed yield was recorded at the harvesting stage.

$$\mathbf{P = \Sigma (v.n) / N.Z \times 100}$$

P = Severity index
v = Score value
n = Number of plants having same score
Z = Maximum scale number
N = Total number of plants observed

RESULTS AND DISCUSSION

The number of stem borer damaged plants was not significantly different among all the treatments before application of insecticides (Table 3). During *yala* 2008, at 7 days after first application, the percentage damaged plants due to stem borer in the plots treated with different insecticides varied from 7 to 22% while the damage in the untreated plots was 29%. At 7 days after second application, the percentage damaged plants in the plots treated with different insecticides varied from 2 to18% while the damaged plants in the untreated plot was 40%.

Table 3. Performances of different insecticides on percentage damaged plants during *yala* 2008 *and yala* 2009 at Mahailluppallama

Treatment	*% Damaged plants**					
	Yala 2008			*Yala 2009*		
	Before app.	*7days after 1st app.*	*7 days after 2rd app.*	*Before app.*	*7days after 1st app.*	*7 days after 2rd app.*
Diazinon 5G (15kg/ha)	16.3	7.5b*	2.9c	34.5	9.5c	5.6c
Fipronil 0.3G (12kg/ha)	18.3	7.9b	3.3c	35.6	4.5c	2.8c
Thio. hy. Ox.4G (15kg/ha)	18.7	14.3ab	10.5b	39.8	5.1c	7.7c
Thio. hy. Ox.4G (20kg/ha)	24.1	7.7b	2.9c	30.5	4.1c	5.5c
Imidacloprid 0.3G (10kg/ha)	21.9	13.5b	17.3b	32.0	21.4b	15.9b
Imidacloprid 0.3G (15kg/ha)	27.2	21.9ab	17.6b	33.5	23.4b	18.5b
Untreated Control	23.7	29.3a	40.3a	40.7	47.2a	35.4a
CV%	ns	20	16	ns	28	29

*Means in a column followed by the same letters are not significantly different at 5% level (analysis based on Arc sin transformed values) ns – not significant

Table 4. Effect of different insecticides on number of larvae and pupae in 10 plant stems during *yala* 2008 *and* 2009 at Mahailluppallama

Treatment	Larvae + Pupae/ 10 plant stems*			
	Yala 2008		*Yala 2009*	
	Larvae + Pupae/ 10 plant stems	*% reduction over control*	*Larvae + Pupae/ 10 plant stems*	*% reduction over control*
Diazinon 5G (15kg/ha)	3.5b	81	16.0b	61
Fipronil 0.3G(12kg/ha)	1.8b	90	10.5b	75
Thio. hy. Ox.4G (15kg/ha)	9.3ab	50	23.0b	45
Thio. hy. Ox.4G (20kg/ha)	3.8b	79	17.0b	59
Imidacloprid 0.3G (10kg/ha)	17.3a	6	43.0a	-
Imidacloprid 0.3G (15kg/ha)	13.5ab	27	42.7a	-
Untreated Control	18.5a	-	42.0a	-
CV%	24		31	

*Means in a column followed by the same letters are not significantly different at 5% level

Table 5. Effect of different insecticides on severity of stem borer damage during *yala* 2008 and 2009 at Mahailluppallama

Treatment	*Severity Index**	
	Yala 2008	*Yala 2009*
Diazinon 5G (15kg/ha)	11.6d	25.0de
Fipronil 0.3G (12kg/ha)	11.6d	14.8e
Thio. hy. Ox. 4G (15 kg/ha)	12.0d	26.8cd
Thio. hy. Ox. 4G (20 kg/ha)	15.3d	22.9de
Imidacloprid 0.3G (10 kg/ha)	27.1c	43.0ab
Imidacloprid 0.3G (15 kg/ha)	33.1b	36.3bc
Control	55.1a	47.6a
CV%	16	21

*Means in a column followed by the same letters are not significantly different at 5% level

The lowest damage was recorded in the plots treated with Diazinon 5G followed by Fipronil 0.3G and Thiocyclam hydrogen oxalate 4G (80ga.i./ha). During *yala* 2009, at 7 days after first and second application, number of damaged plants were significantly low in Diazinon 5G, Fipronil 0.3G and Thiocyclam hydrogen oxalate 4G (800g a.i./ha) treated plots.

The larval and pupal population in 10 plant stems was significantly low in Diazinon, Fipronil and Thiocyclam hydrogen oxalate (800ga.i./ha) treated plots compared to that of the untreated control plot during both seasons (Table 4). The percentage reduction of stem borer population ranged from 79-90% and 59-75% in these three insecticide treated plots over the control plot during *yala* 2008 and *yala* 2009 respectively.

The severity of stem borer damage during yala 2008 was significantly low in all the insecticide treated plots compared to the untreated plot (Table 5). Diazinon, Fipronil and Thiocyclam hydrogen oxalate found to be superior in reducing stem borer damage during both seasons.

Table 6. Effect of different insecticides on seed yield of maize during *yala* 2008 and 2009 at Mahailluppallama

Treatment	*Yala 2008*		*Yala 2009*	
	Seed yield (t/ha)	*% yield increase over the control*	*Seed yield (t/ha)*	*% yield increase over the control*
Diazinon 5G (15kg/ha)	3.8ab*	65	4.6ab	28
Fipronil 0.3G (12kg/ha)	4.4a	91	5.2a	44
Thio. hy. Ox. 4G (15kg/ha)	3.3ab	43	4.4b	22
Thio. hy. Ox. 4G (20kg/ha)	3.5ab	52	4.6ab	28
Imidacloprid 0.3G (10kg/ha)	2.5c	9	3.7c	3
Imidacloprid 0.3G (15kg/ha)	2.6bc	13	3.3c	-
Control	2.3c	-	3.6c	-
CV%	23		14	

*Means in a column followed by the same letters are not significantly different at 5% level

Diazinon, Fipronil and Thiocyclam treated plots gave significantly higher yields than the control plot during both seasons. Yields in Diazinon, Fipronil and Thiocyclam hydrogen oxalate (800ga.i./ha) treated plots found to be 52-91% and 28-44% higher compared to the control during *yala* 2008 and *yala* 2009 respectively (Table 6).

CONCLUSION

Among the different granular insecticides (Diazinon 5G, Fipronil 0.3G, Thiocyclam hydrogen Oxalate 4G, Imidacloprid 0.3G) evalu-

ated Fipronil 0.3G (@12kg/ha) and Thiocyclam hydrogen oxalate 4G (@20 kg/ha) found to be significantly superior in controlling maize stem borer damage. Hence, whorl application of these two granular insecticides can be suggested for effective management of stem borer infestation in maize.

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